

**CEQA PRELIMINARY HYDROLOGY/DRAINAGE STUDY  
FOR  
TRACT NUMBER 5392**

**SAN DIEGO, CALIFORNIA**

PREPARED FOR:

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Anaheim, California 92805**

PREPARED BY:

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February 2005  
Revised: May 2005

CEQA PRELIMINARY HYDROLOGY/DRAINAGE STUDY  
FOR  
TRACT NUMBER 5392

SAN DIEGO, CALIFORNIA

**ACKNOWLEDGMENT AND SIGNATURE PAGE**

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This Hydrology Study prepared by MV Consulting Engineers, under the supervision of Massoud Vatankhahi, P.E.



*M. Vatankhahi*

Massoud Vatankhahi, P.E., 37348  
Principal, MV Consulting Engineers

5/9/05

Date

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Exhibit 2	On-Site Hydrology Map (Proposed Condition)
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## ***1.0 PURPOSE***

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The purpose of this report is:

- To satisfy the requirements of the conditions of approval necessary to support the proposed development.

## **2.0 INTRODUCTION**

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Subject property is in an "L-shaped" and contains of 1.15 Acres of land situated adjacent and on the east side of Sweetwater road, south of Ildica Street, in the vicinity of Spring Valley, County of San Diego.

There is an existing 28 feet wide paved Access Road at northerly part of the subject property which is accessing Sweetwater Road to adjacent apartment complex located at north- easterly side of subject property (2049 Sweetwater Road). Also there is an existing 6 foot high Earth-Berm (Sound Berm) along the westerly side of the subject land and adjacent to westerly property line which has been constructed recently by Caltrans for purpose of sound mitigation and is subject to remain in place.

### **a. Existing Condition**

Subject property sloping down westerly with approximately 10% of slope into an existing temporary drainage ditch located at the toe of the existing sound berm. The drainage ditch carries the storm water from north of the project site by an 18 inch culvert which is under the existing access road. The tributary drainage area to the 18" RCP culvert is approximately 2.9 acres and no flows from the Ildica Street contributes to this off-site drainage area (See Hydrology Map for Existing Condition and also Figure 5). There is also an 8 inch storm drain from the adjacent apartment complex that discharging into subject property over a rip-rap and then sheet flows towards the said drainage ditch. The drainage ditch collects all the on-site and the off-site storm drains, then flows southerly and passes the property line and then drains into a 30" CSP drop inlet which has been built recently by Caltrans. This new drop inlet drains to 24" RCP. The 24" RCP carries the flows to an existing RCB that is constructed under the Sweetwater Road by Caltrans (See Figure 6).

### **b. Proposed Condition by Tentative Tract Map**

Per Tentative Tract map, we are proposing to install the followings:

- Remove existing temporary drainage ditch and replace it with a 24-inch Corrugated Still Pipe (CSP).
- Construct a catch basin with traffic rated grate at the low point of the existing access road.
- Construct a junction structure to collect storm water from the proposed catch basin above and from the 8 inch storm drain run-off from the apartment complex into our property.
- Construct also a catch basin at the low point of the west of the property to collect on-site storm drain and discharge it into proposed 24-inch CSP storm drain.

### **Note:**

The westerly portion of subject property used to be in flood zone, but since the Caltrans has built the SR125 FWY, the area is no longer in flood zone due to the fact that a large reinforced Concrete Box has been constructed under the Sweetwater Rd. by Caltrans to mitigate the drainage problem in the area

## 3.0 METHODOLOGY

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- The 2003 Year County of San Diego Hydrology Manual Design Criteria Procedure was used to calculate the 100-year peak runoff.
- The 20- and 50-scale Grading Plan prepared by Hoss, William and Associates, Inc. was used as a base map for the hydrology map.
- Soils map was prepared based on the he County of San Diego Hydrology Manual Design (See Figure 2).
- San Diego Hydrology Manual 100-Year Rainfall Event, -6 and -24 Hour Maps was used in the Rational Method Hydrology (See Figures 3 and 4)
- Hydrocalc Hydraulics program by Dodson was used to perform hydraulic analysis.

### ***3.0 REFERENCES***

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- The County of San Diego Hydrology Manual
- Grading Plan prepared by Hoss, William and Associates, Inc., *dated January 2005*
- *Dodson Hydrocalc Hydraulics, developed by Dodson Company*

## FINDING AND CONCLUSION

Based on performance of this hydrology study (on-site and off-site ) and hydraulic calculations of (on-site and downstream facilities), I conclude that development of this project will not exceed the capacity of existing or planned storm water drainage system.

Sincerely;



*M. Vatankhahi*

8/29/05

Massoud Vatankhahi, PE 37348  
Principal of MV Consulting

Date

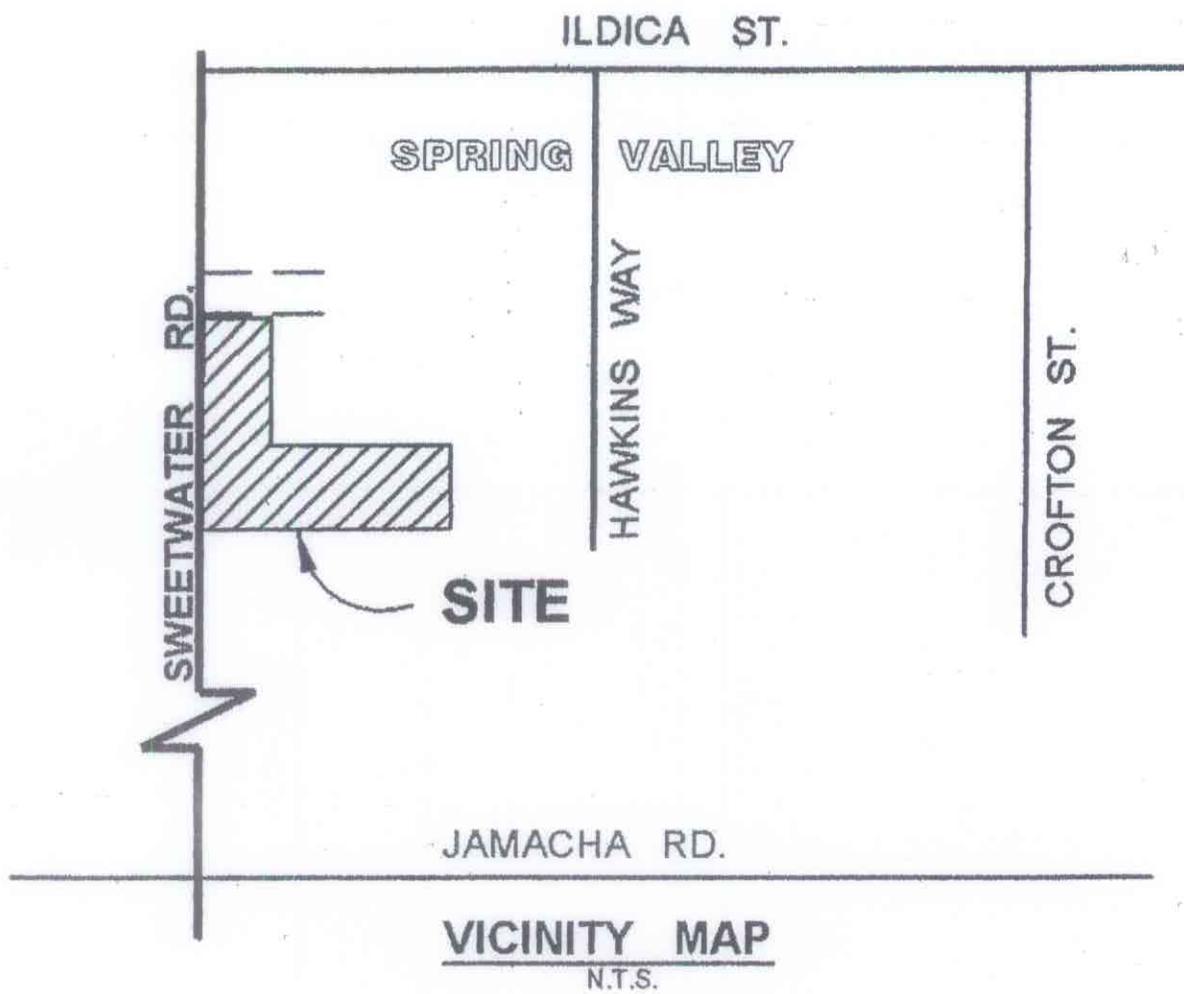


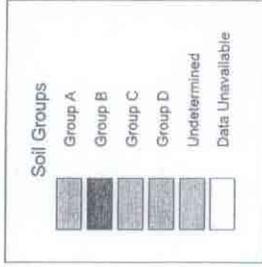
FIG. 1

# County of San Diego Hydrology Manual

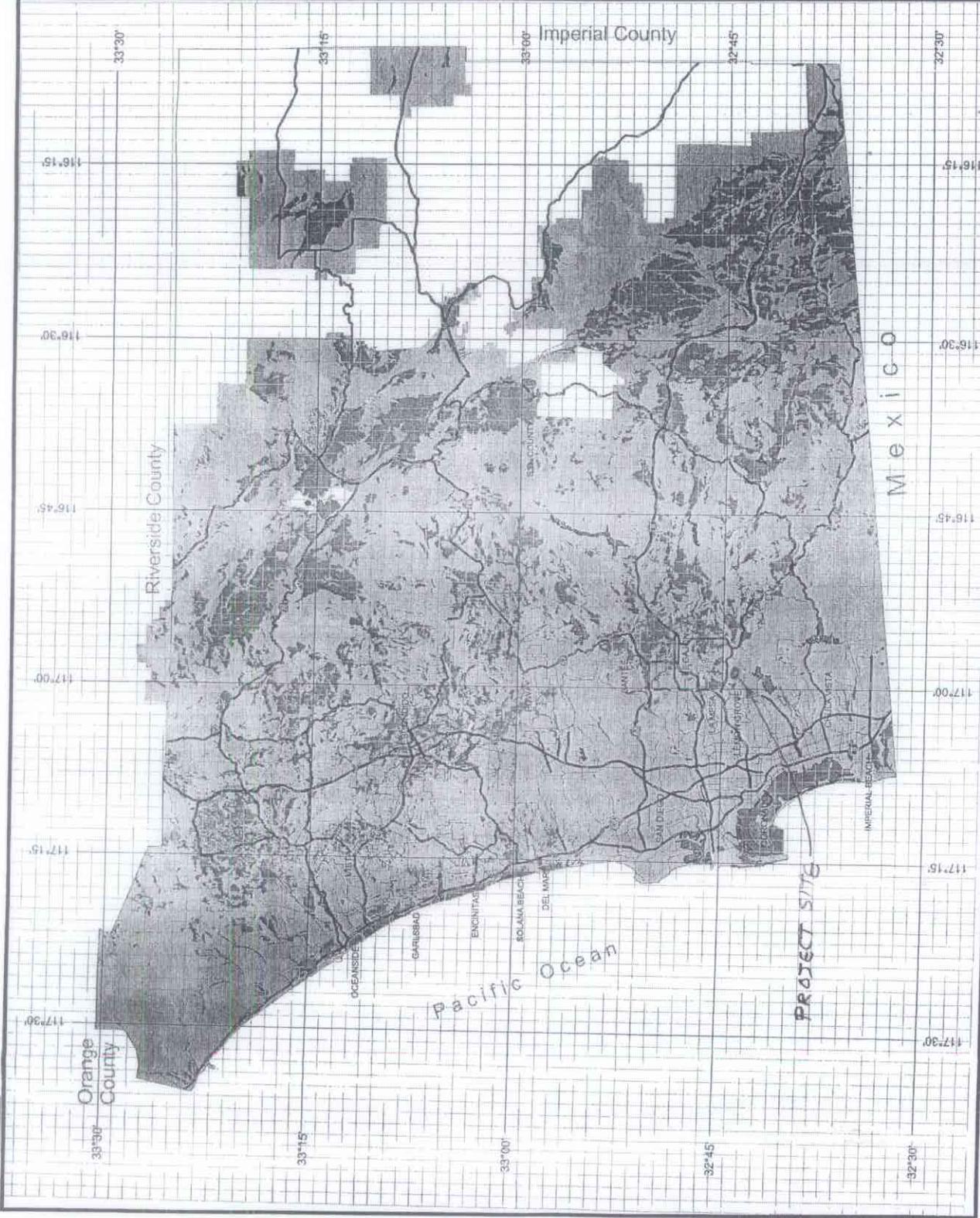


## Soil Hydrologic Groups

### Legend



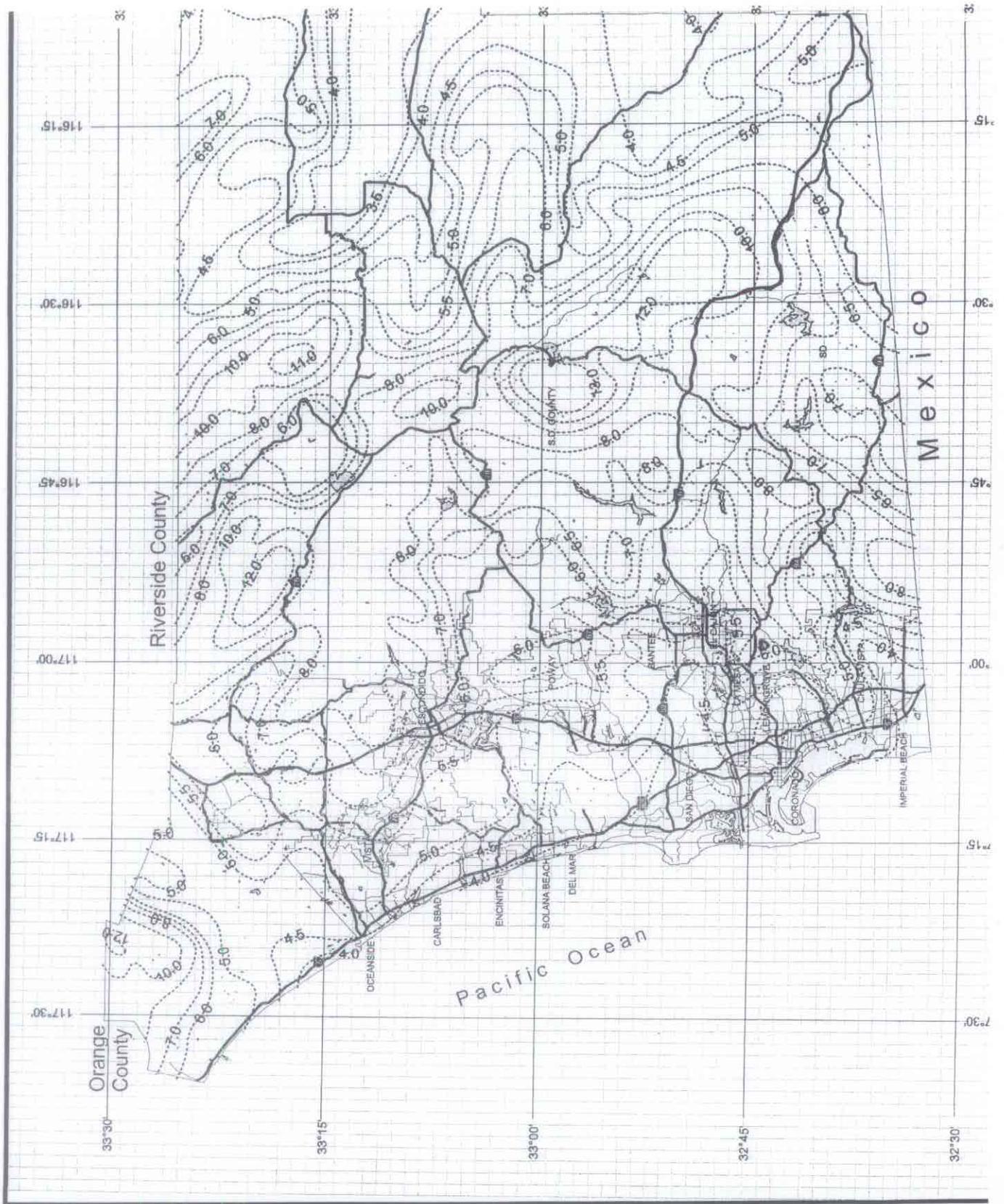
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SOIL GROUP "D" WAS USED IN  
HYDROLOG STUDY

FIG. 2





6.5

100-YR RAINFALL EVENT-24HR.

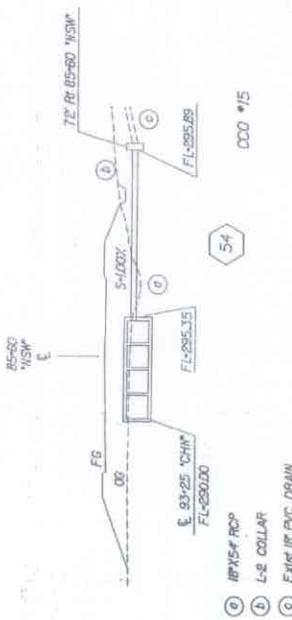
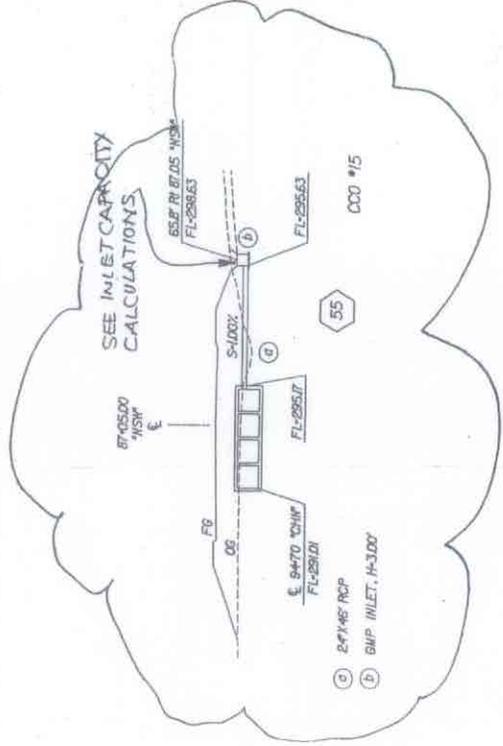
FIG. 4



DIST	COUNTY	ROUTE	POST MILE	SHEET TOTAL
11	SD	125	11.8/13.2	96d 356

REGISTERED CIVIL ENGINEER  
*Howard D. Bergin*

2-26-96  
 PLANS APPROVAL DATE  
 TS BOURQUIN  
 48830  
 9-30-96  
 CIVIL  
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**AS-BUILT PLANS**  
 CONTRACT NO. 11-001911  
 DATE COMPLETED 11/2/98  
 RE: J. LOVE

54 55

**DRAINAGE PROFILE**  
 NO SCALE

D-43d

THIS PLAN ACCURATE FOR DRAINAGE ONLY

FOR REDUCED PLANS  
 ORIGINAL SCALE IS IN INCHES 0 1 2 3

USER NAME \*3 TBTFC0516  
 DGN FILE \*3 D00191143d\_0002165031

CU 11287

EA 001911

FIG. C

NOTE:  
 FOR COMPLETE RIGHT-OF-WAY AND  
 ACCURATE ACCESS DATA - SEE RIGHT  
 OF WAY RECORD MAPS AT DISTRICT OFFICE.

MOUNT MIGUEL HIGH SCHOOL

BLOSSOM LANE

SWEETWATER ROAD

MATCH LINE B3+50 "SWR"

MATCH LINE 96+50 "SWR"

POST MILES SHEET TOTAL PROJECT NO. SHEET NO.

11	SD	125	11, 6/13, 2	60	356
----	----	-----	-------------	----	-----

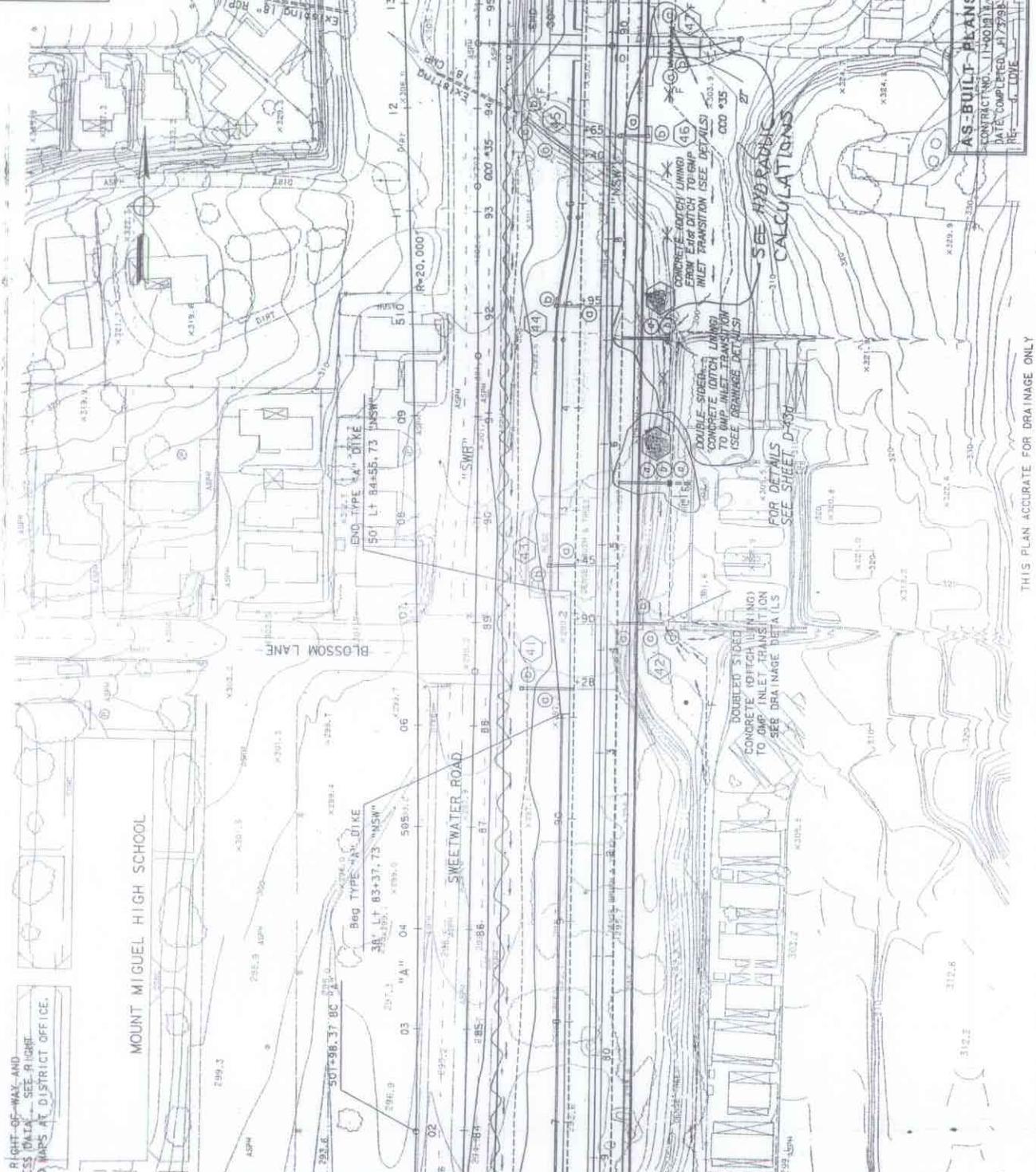
REGISTERED CIVIL ENGINEER

*Thomas J. Bouquin*

2-26-96  
 PLANS APPROVAL DATE

TS BOUQUIN  
 48839  
 9-30-96  
 CIVIL

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AS-BUILT PLANS  
 CONTRACT NO. 11-001911  
 DATE COMPLETED 11/7/2011  
 REF. 6 - COVER

41 42 43 44 45 46 47

DRAINAGE PLAN  
 D-7

SCALE: 1"=50'

THIS PLAN ACCURATE FOR DRAINAGE ONLY

FOR REDUCED PLANS  
 ORIGINAL SCALE 1/8" = 1'

1 2 3

USER NAME: 11-001911.DWG  
 DGN FILE: 11-001911.DWG

CU 11287

EA 001911

0-08-02-00 (REV. 3/2001)

100000 PROJECT DEVELOPMENT T. S. BOUQUIN

FIG. 7



**APPENDIX A**

**HYDROLOGY STUDY  
FOR EXISTING CONDITION  
(100-YEAR STORM EVENTS)**

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c)1991-2004 Version 7.4

Rational method hydrology program based on  
San Diego County Flood Control Division 2003 hydrology manual  
Rational Hydrology Study Date: 02/01/05

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HYDROLOGY STUDY FOR  
TENTATIVE TRACT NO. 5392  
100-YEAR STORM EVENT

---

\*\*\*\*\* Hydrology Study Control Information \*\*\*\*\*

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Program License Serial Number 4000

---

Rational hydrology study storm event year is 100.0  
English (in-lb) input data Units used

Map data precipitation entered:  
6 hour, precipitation(inches) = 2.900  
24 hour precipitation(inches) = 6.500  
P6/P24 = 44.6%  
Adjusted 6 hour precipitation (inches) = 2.925  
Adjusted P6/P24 = 45.0%  
San Diego hydrology manual 'C' values used

\*\*\*\*\*  
 Process from Point/Station 1.000 to Point/Station 2.000  
 \*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Decimal fraction soil group A = 0.000  
 Decimal fraction soil group B = 0.000  
 Decimal fraction soil group C = 0.000  
 Decimal fraction soil group D = 1.000  
 [MEDIUM DENSITY RESIDENTIAL ]  
 (4.3 DU/A or Less )  
 Impervious value, Ai = 0.300  
 Sub-Area C Value = 0.520  
 Initial subarea total flow distance = 700.000(Ft.)  
 Highest elevation = 330.000(Ft.)  
 Lowest elevation = 303.000(Ft.)  
 Elevation difference = 27.000(Ft.) Slope = 3.857 %  
 Top of Initial Area Slope adjusted by User to 6.000 %  
 Bottom of Initial Area Slope adjusted by User to 1.000 %  
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:  
 The maximum overland flow distance is 100.00 (Ft)  
 for the top area slope value of 6.00 %, in a development type of  
 4.3 DU/A or Less  
 In Accordance With Table 3-2  
 Initial Area Time of Concentration = 6.70 minutes  
 (for slope value of 5.00 %)  
 The initial area total distance of 700.00 (Ft.) entered leaves a  
 remaining distance of 600.00 (Ft.)  
 Using Figure 3-4, the travel time for this distance is 6.34 minutes  
 for a distance of 600.00 (Ft.) and a slope of 1.00 %  
 with an elevation difference of 6.00(Ft.) from the end of the top area  
 $Tt = [(11.9 * \text{length}(\text{Mi})^3) / (\text{elevation change}(\text{Ft.}))]^{.385} * 60(\text{min/hr})$   
 = 6.335 Minutes  
 $Tt = [(11.9 * 0.1136^3) / (6.00)]^{.385} = 6.34$   
 Total initial area Ti = 6.70 minutes from Table 3-2 plus  
 6.34 minutes from the Figure 3-4 formula = 13.04 minutes  
 Rainfall intensity (I) = 4.154(In/Hr) for a 100.0 year storm  
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.520  
 Subarea runoff = 6.221(CFS)  
 Total initial stream area = 2.880(Ac.)

+++++  
Process from Point/Station 2.000 to Point/Station 3.000  
\*\*\*\* PIPEFLOW TRAVEL TIME (User specified size) \*\*\*\*

---

Upstream point/station elevation = 303.000 (Ft.)  
Downstream point/station elevation = 302.000 (Ft.)  
Pipe length = 50.00 (Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 6.221 (CFS)  
Given pipe size = 18.00 (In.)  
Calculated individual pipe flow = 6.221 (CFS)  
Normal flow depth in pipe = 8.12 (In.)  
Flow top width inside pipe = 17.91 (In.)  
Critical Depth = 11.57 (In.)  
Pipe flow velocity = 8.03 (Ft/s)  
Travel time through pipe = 0.10 min.  
Time of concentration (TC) = 13.14 min.

\*\*\*\*\*  
Process from Point/Station 3.000 to Point/Station 3.000  
\*\*\*\* SUBAREA FLOW ADDITION \*\*\*\*

---

Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
[HIGH DENSITY RESIDENTIAL ]  
(24.0 DU/A or Less )  
Impervious value, Ai = 0.650  
Sub-Area C Value = 0.710  
Time of concentration = 13.14 min.  
Rainfall intensity = 4.133(In/Hr) for a 100.0 year storm  
Effective runoff coefficient used for total area  
(Q=KCIA) is C = 0.562 CA = 2.080  
Subarea runoff = 2.374(CFS) for 0.820(Ac.)  
Total runoff = 8.595(CFS) Total area = 3.700(Ac.)

\*\*\*\*\*  
Process from Point/Station 3.000 to Point/Station 4.000  
\*\*\*\* IMPROVED CHANNEL TRAVEL TIME \*\*\*\*

---

Upstream point elevation = 302.000 (Ft.)  
Downstream point elevation = 299.000 (Ft.)  
Channel length thru subarea = 250.000 (Ft.)  
Channel base width = 3.000 (Ft.)  
Slope or 'Z' of left channel bank = 1.000  
Slope or 'Z' of right channel bank = 1.000  
Estimated mean flow rate at midpoint of channel = 9.403 (CFS)  
Manning's 'N' = 0.015  
Maximum depth of channel = 1.000 (Ft.)  
Flow (q) thru subarea = 9.403 (CFS)  
Depth of flow = 0.475 (Ft.), Average velocity = 5.695 (Ft/s)  
Channel flow top width = 3.950 (Ft.)  
Flow Velocity = 5.69 (Ft/s)  
Travel time = 0.73 min.  
Time of concentration = 13.87 min.  
Critical depth = 0.625 (Ft.)  
Adding area flow to channel  
Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
[UNDISTURBED NATURAL TERRAIN ]  
(Permanent Open Space )  
Impervious value, Ai = 0.000  
Sub-Area C Value = 0.350  
Rainfall intensity = 3.991 (In/Hr) for a 100.0 year storm  
Effective runoff coefficient used for total area  
(Q=KCIA) is C = 0.507 CA = 2.535  
Subarea runoff = 1.521 (CFS) for 1.300 (Ac.)  
Total runoff = 10.115 (CFS) Total area = 5.000 (Ac.)  
Depth of flow = 0.496 (Ft.), Average velocity = 5.832 (Ft/s)  
Critical depth = 0.656 (Ft.)  
End of computations, total study area = 5.000 (Ac.)

**APPENDIX B**

**HYDROLOGY STUDY  
FOR PROPOSED CONDITION  
(100-YEAR STORM EVENTS)**

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c)1991-2004 Version 7.4

Rational method hydrology program based on  
San Diego County Flood Control Division 2003 hydrology manual  
Rational Hydrology Study Date: 02/01/05

-----  
HYDROLOGY STUDY FOR TRACT 5392  
PROPOSED CONDITION  
100-YEAR PEAK RUNOFF  
-----

\*\*\*\*\* Hydrology Study Control Information \*\*\*\*\*  
-----

Program License Serial Number 4000

-----  
Rational hydrology study storm event year is 100.0  
English (in-lb) input data Units used

Map data precipitation entered:  
6 hour, precipitation(inches) = 2.900  
24 hour precipitation(inches) = 6.500  
P6/P24 = 44.6%  
Adjusted 6 hour precipitation (inches) = 2.925  
Adjusted P6/P24 = 45.0%  
San Diego hydrology manual 'C' values used

\*\*\*\*\*  
Process from Point/Station 10.000 to Point/Station 11.000  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
[HIGH DENSITY RESIDENTIAL ]  
(24.0 DU/A or Less )  
Impervious value, Ai = 0.650  
Sub-Area C Value = 0.710  
Initial subarea total flow distance = 265.000(Ft.)  
Highest elevation = 330.000(Ft.)  
Lowest elevation = 322.000(Ft.)  
Elevation difference = 8.000(Ft.) Slope = 3.019 %  
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:  
The maximum overland flow distance is 90.00 (Ft)  
for the top area slope value of 3.02 %, in a development type of  
24.0 DU/A or Less  
In Accordance With Table 3-2  
Initial Area Time of Concentration = 8.10 minutes  
(for slope value of 3.00 %)  
The initial area total distance of 265.00 (Ft.) entered leaves a  
remaining distance of 175.00 (Ft.)  
Using Figure 3-4, the travel time for this distance is 1.60 minutes  
for a distance of 175.00 (Ft.) and a slope of 3.02 %  
with an elevation difference of 5.28(Ft.) from the end of the top area  
 $T_t = [11.9 * \text{length}(\text{Mi})^3 / (\text{elevation change}(\text{Ft.}))]^{.385} * 60(\text{min/hr})$   
= 1.603 Minutes  
 $T_t = [(11.9 * 0.0331^3) / (5.28)]^{.385} = 1.60$   
Total initial area  $T_i$  = 8.10 minutes from Table 3-2 plus  
1.60 minutes from the Figure 3-4 formula = 9.70 minutes  
Rainfall intensity (I) = 5.025(In/Hr) for a 100.0 year storm  
Effective runoff coefficient used for area (Q=KCIA) is C = 0.710  
Subarea runoff = 1.927(CFS)  
Total initial stream area = 0.540(Ac.)

\*\*\*\*\*  
Process from Point/Station 11.000 to Point/Station 12.000  
\*\*\*\* PIPEFLOW TRAVEL TIME (User specified size) \*\*\*\*

---

Upstream point/station elevation = 319.000 (Ft.)  
Downstream point/station elevation = 305.000 (Ft.)  
Pipe length = 40.00 (Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 1.927 (CFS)  
Given pipe size = 8.00 (In.)  
Calculated individual pipe flow = 1.927 (CFS)  
Normal flow depth in pipe = 2.84 (In.)  
Flow top width inside pipe = 7.65 (In.)  
Critical Depth = 7.45 (In.)  
Pipe flow velocity = 17.39 (Ft/s)  
Travel time through pipe = 0.04 min.  
Time of concentration (TC) = 9.74 min.

\*\*\*\*\*  
Process from Point/Station 12.000 to Point/Station 12.000  
\*\*\*\* SUBAREA FLOW ADDITION \*\*\*\*

---

Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
[HIGH DENSITY RESIDENTIAL ]  
(24.0 DU/A or Less )  
Impervious value, Ai = 0.650  
Sub-Area C Value = 0.710  
Time of concentration = 9.74 min.  
Rainfall intensity = 5.012(In/Hr) for a 100.0 year storm  
Effective runoff coefficient used for total area  
(Q=KCIA) is C = 0.710 CA = 0.462  
Subarea runoff = 0.387(CFS) for 0.110(Ac.)  
Total runoff = 2.313(CFS) Total area = 0.650(Ac.)

\*\*\*\*\*  
Process from Point/Station 12.000 to Point/Station 13.000  
\*\*\*\* PIPEFLOW TRAVEL TIME (User specified size) \*\*\*\*

---

Upstream point/station elevation = 305.000 (Ft.)  
Downstream point/station elevation = 303.500 (Ft.)  
Pipe length = 38.00 (Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 2.313 (CFS)  
Given pipe size = 8.00 (In.)  
Calculated individual pipe flow = 2.313 (CFS)  
Normal flow depth in pipe = 6.31 (In.)  
Flow top width inside pipe = 6.53 (In.)  
Critical depth could not be calculated.  
Pipe flow velocity = 7.83 (Ft/s)  
Travel time through pipe = 0.08 min.  
Time of concentration (TC) = 9.82 min.

\*\*\*\*\*  
Process from Point/Station 13.000 to Point/Station 13.000  
\*\*\*\* SUBAREA FLOW ADDITION \*\*\*\*

---

Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
[HIGH DENSITY RESIDENTIAL ]  
(24.0 DU/A or Less )  
Impervious value, Ai = 0.650  
Sub-Area C Value = 0.710  
Time of concentration = 9.82 min.  
Rainfall intensity = 4.986(In/Hr) for a 100.0 year storm  
Effective runoff coefficient used for total area  
(Q=KCIA) is C = 0.710 CA = 0.618  
Subarea runoff = 0.766(CFS) for 0.220(Ac.)  
Total runoff = 3.080(CFS) Total area = 0.870(Ac.)

\*\*\*\*\*  
Process from Point/Station 13.000 to Point/Station 14.000  
\*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 303.500 (Ft.)  
Downstream point/station elevation = 301.500 (Ft.)  
Pipe length = 38.00 (Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 3.080 (CFS)  
Nearest computed pipe diameter = 9.00 (In.)  
Calculated individual pipe flow = 3.080 (CFS)  
Normal flow depth in pipe = 6.15 (In.)  
Flow top width inside pipe = 8.37 (In.)  
Critical depth could not be calculated.  
Pipe flow velocity = 9.57 (Ft/s)  
Travel time through pipe = 0.07 min.  
Time of concentration (TC) = 9.89 min.

\*\*\*\*\*  
Process from Point/Station 14.000 to Point/Station 14.000  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 1  
Stream flow area = 0.870 (Ac.)  
Runoff from this stream = 3.080 (CFS)  
Time of concentration = 9.89 min.  
Rainfall intensity = 4.964 (In/Hr)

\*\*\*\*\*  
Process from Point/Station 14.000 to Point/Station 14.000  
\*\*\*\* USER DEFINED FLOW INFORMATION AT A POINT \*\*\*\*

---

Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
[MEDIUM DENSITY RESIDENTIAL ]  
(4.3 DU/A or Less )  
Impervious value, Ai = 0.300  
Sub-Area C Value = 0.520  
Rainfall intensity (I) = 4.161(In/Hr) for a 100.0 year storm  
User specified values are as follows:  
TC = 13.00 min. Rain intensity = 4.16(In/Hr)  
Total area = 2.880(Ac.) Total runoff = 6.200(CFS)

Process from Point/Station 14.000 to Point/Station 14.000  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

Along Main Stream number: 1 in normal stream number 2  
 Stream flow area = 2.880 (Ac.)  
 Runoff from this stream = 6.200 (CFS)  
 Time of concentration = 13.00 min.  
 Rainfall intensity = 4.161 (In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	3.080	9.89	4.964
2	6.200	13.00	4.161
Qmax(1) =			
	1.000 *	1.000 *	3.080) +
	1.000 *	0.761 *	6.200) + = 7.796
Qmax(2) =			
	0.838 *	1.000 *	3.080) +
	1.000 *	1.000 *	6.200) + = 8.781

Total of 2 streams to confluence:

Flow rates before confluence point:

3.080      6.200

Maximum flow rates at confluence using above data:

7.796      8.781

Area of streams before confluence:

0.870      2.880

Results of confluence:

Total flow rate = 8.781 (CFS)

Time of concentration = 13.000 min.

Effective stream area after confluence = 3.750 (Ac.)

\*\*\*\*\*  
Process from Point/Station            14.000 to Point/Station            15.000  
\*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation =    301.000(Ft.)  
Downstream point/station elevation =    300.500(Ft.)  
Pipe length =    140.00(Ft.)    Manning's N = 0.013  
No. of pipes = 1    Required pipe flow =        8.781(CFS)  
Nearest computed pipe diameter =        21.00(In.)  
Calculated individual pipe flow =        8.781(CFS)  
Normal flow depth in pipe =    15.98(In.)  
Flow top width inside pipe =    17.91(In.)  
Critical Depth =    13.21(In.)  
Pipe flow velocity =        4.47(Ft/s)  
Travel time through pipe =        0.52 min.  
Time of concentration (TC) =        13.52 min.

+++++  
Process from Point/Station 15.000 to Point/Station 15.000  
\*\*\*\* SUBAREA FLOW ADDITION \*\*\*\*

---

Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
[HIGH DENSITY RESIDENTIAL ]  
(24.0 DU/A or Less )  
Impervious value, Ai = 0.650  
Sub-Area C Value = 0.710  
Time of concentration = 13.52 min.  
Rainfall intensity = 4.057(In/Hr) for a 100.0 year storm  
Effective runoff coefficient used for total area  
(Q=KCIA) is C = 0.596 CA = 2.854  
Subarea runoff = 2.795(CFS) for 1.040(Ac.)  
Total runoff = 11.577(CFS) Total area = 4.790(Ac.)

\*\*\*\*\*  
Process from Point/Station 15.000 to Point/Station 16.000  
\*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 300.500(Ft.)  
Downstream point/station elevation = 299.000(Ft.)  
Pipe length = 110.00(Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 11.577(CFS)  
Nearest computed pipe diameter = 18.00(In.)  
Calculated individual pipe flow = 11.577(CFS)  
Normal flow depth in pipe = 13.92(In.)  
Flow top width inside pipe = 15.07(In.)  
Critical Depth = 15.55(In.)  
Pipe flow velocity = 7.90(Ft/s)  
Travel time through pipe = 0.23 min.  
Time of concentration (TC) = 13.75 min.  
End of computations, total study area = 4.790 (Ac.)

## **APPENDIX C**

### **HYDRAULIC ANALYSES**

CIRCULAR CHANNEL ANALYSIS  
 RATING CURVE COMPUTATION  
 FOR STORM DRAIN NO. 55 (SEE FIG. 7)  
 TR. NO. 5392  
 February 10, 2005

55

PROGRAM INPUT DATA

DESCRIPTION VALUE	
Channel Bottom Slope (ft/ft).....	0.010
Manning's Roughness Coefficient (n-value).....	0.013
Channel Diameter (ft).....	2.0
Minimum Flow Depth (ft).....	0.1
Maximum Flow Depth (ft).....	2.1
Incremental Head (ft).....	0.1

COMPUTATION RESULTS

Flow Depth (ft)	Flow Rate (cfs)	Flow Velocity (fps)	Froude Number	Velocity Head (ft)	Energy Head (ft)	Flow Area (sq ft)	Top Width (ft)
0.1	0.11	1.85	1.256	0.053	0.153	0.06	0.87
0.2	0.47	2.89	1.38	0.13	0.33	0.16	1.2
0.3	1.1	3.72	1.442	0.215	0.515	0.3	1.43
0.4	1.98	4.43	1.477	0.305	0.705	0.45	1.6
0.5	3.1	5.05	1.494	0.396	0.896	0.61	1.73
0.6	4.43	5.59	1.498	0.485	1.085	0.79	1.83
0.7	5.95	6.07	1.493	0.573	1.273	0.98	1.91
0.8	7.62	6.5	1.48	0.656	1.456	1.17	1.96
0.9	9.42	6.87	1.46	0.734	1.634	1.37	1.99
1.0	11.31	7.2	1.432	0.806	1.806	1.57	2.0
1.1	13.25	7.48	1.399	0.87	1.97	1.77	1.99
1.2	15.2	7.72	1.358	0.927	2.127	1.97	1.96
1.3	17.11	7.92	1.311	0.974	2.274	2.16	1.91
1.4	18.94	8.06	1.256	1.01	2.41	2.35	1.83
1.5	20.63	8.16	1.191	1.035	2.535	2.53	1.73
1.6	22.11	8.21	1.115	1.047	2.647	2.69	1.6
1.7	23.31	8.19	1.023	1.042	2.742	2.85	1.43
1.8	24.11	8.1	0.906	1.018	2.818	2.98	1.2
1.9	24.31	7.88	0.739	0.966	2.866	3.08	0.87
2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

COMPUTATION NOTES

\*\*\* Rating Curve terminated at flow depth = 2.00  
 Flow depth equals or exceeds channel diameter (2.00)

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 Phone: (281) 440-3787, Fax: (281) 440-4742, Email: software@dodson-hydro.com  
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CHECK CAPACITY OF 30" DIA. DROP INLET (SEE FIG. 6)

USE WEIR FORMULA

$$Q = C \pi D H^{1.5}$$

C = WEIR COEFFICIENT

$$= 3.22 + 0.44 \frac{H}{P}$$

H = HEAD OVER THE INLET = 2.0'

P = HEIGHT OF THE DROP INLET = 3.0'

$$C = 3.22 + 0.44 \frac{2.0}{3.0} = 3.51$$

ASSUME 50% CLOGGING

$$Q = \frac{C \pi D H^{1.5}}{2}$$

$$= \frac{3.51 \times 3.5 \times (2.0)^{1.5}}{2} = 12.4 \text{ CFS} > Q_{100} = 11.6 \text{ CFS} \therefore \text{O.K.}$$

CIRCULAR CHANNEL ANALYSIS  
NORMAL DEPTH COMPUTATION  
FOR TR. NO.5392

February 12, 2005

PROGRAM INPUT DATA

DESCRIPTION  
VALUE

Flow Rate (cfs).....	11.6
Channel Bottom Slope (ft/ft).....	0.0125
Manning's Roughness Coefficient (n-value).....	0.0224
Channel Diameter (ft).....	2.0

COMPUTATION RESULTS

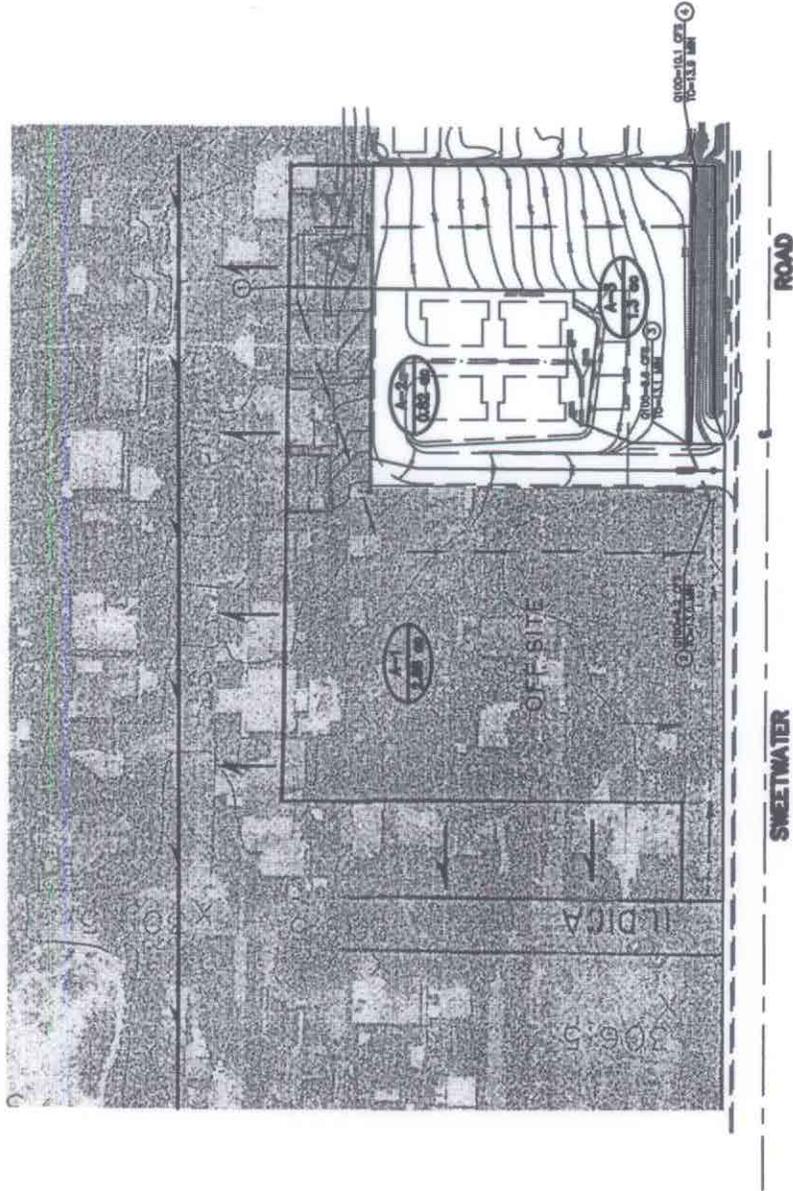
DESCRIPTION  
VALUE

Normal Depth (ft).....	1.34
Flow Velocity (fps).....	5.18
Froude Number.....	0.836
Velocity Head (ft).....	0.42
Energy Head (ft).....	1.76
Cross-Sectional Area of Flow (sq ft).....	2.24
Top Width of Flow (ft).....	1.88

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**EXHIBIT 1**

**HYDROLOGY MAPS**

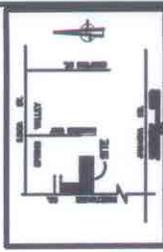


SCALE: 1"=50'

**LEGEND**  
 — DRAINAGE AREA BOUNDARY  
 — FLOW PATH

○ DRAINAGE AREA NUMBER  
 ○ A-1  
 3.25 AC  
 ○ DRAINAGE AREA IN ACRES

① 100-YR PEAK RUNOFF IN CUBIC FEET PER SECOND  
 ② TIME OF CONCENTRATION IN MINUTES

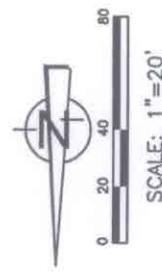
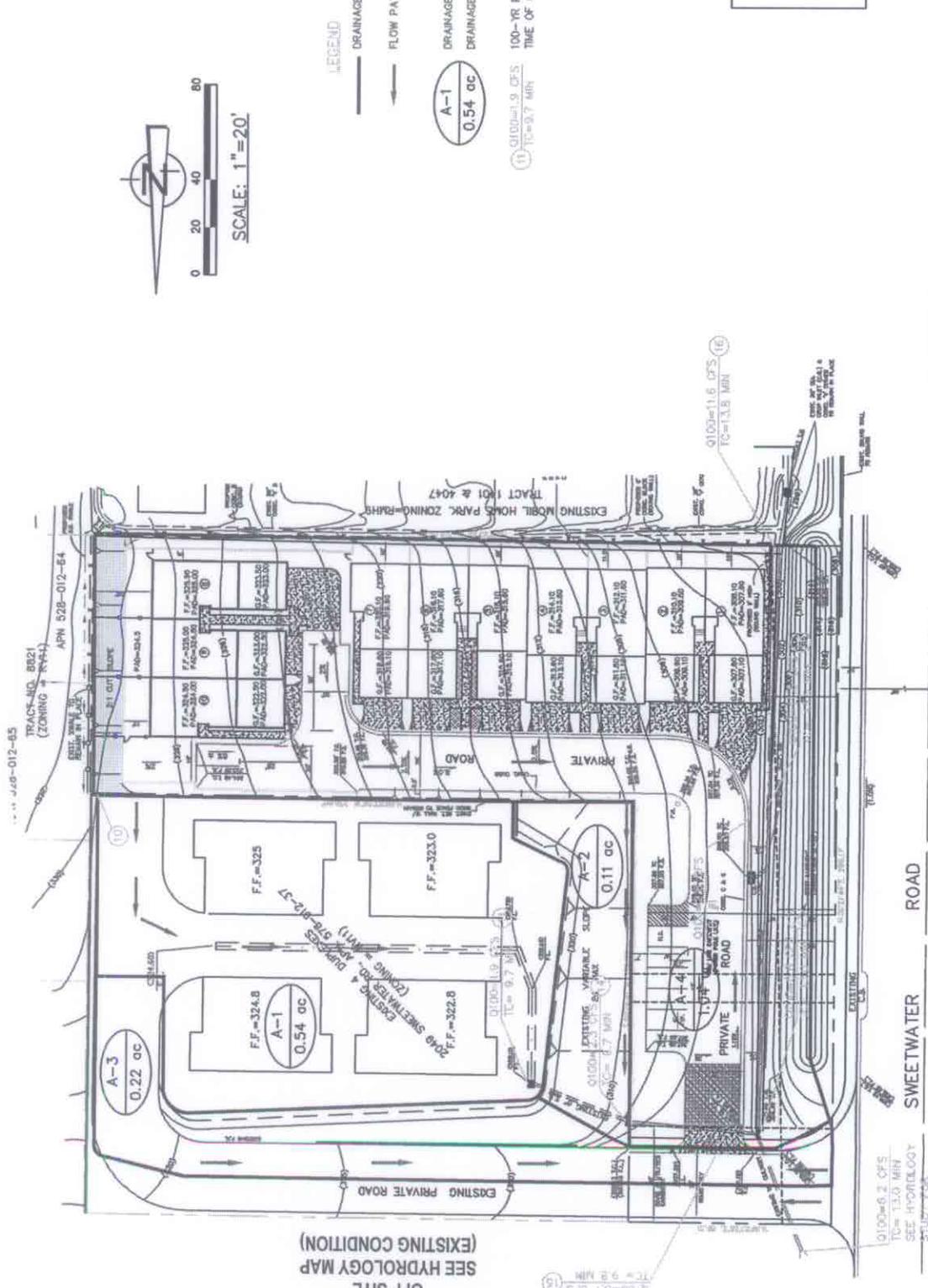


COUNTY OF SUTTER  
 (DISTRICT CONDITION)  
**HYDROLOGY MAP**  
 TENTATIVE TB. 532  
 SCALE: 1"=50' SHEET 1 OF 1

PREPARED BY  

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**SEARCH INDEX**  
 2" BRASS DISK CH23 N. PG. LINDA STREET  
 12" W. LINDA CT. COUNTY ENGR.  
 ELEVATION = 428.21  
 P.C. (100%)



- LEGEND**
- DRAINAGE AREA BOUNDARY
  - FLOW PATH
  - A-1  
0.54 ac  
DRAINAGE AREA NUMBER  
DRAINAGE AREA IN ACRES

⑪ Q100=11.6 CFS  
TC=13.8 MIN  
100-YR PEAK RUNOFF IN CUBIC FEET PER SECOND  
TIME OF CONCENTRATION IN MINUTES



PREPARED BY  
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BENCH MARK  
 2" BRASS DSK CRV2 N. PC LONCA STREET  
 17' W. LONCA CTY. COUNTY ENGR.  
 ELEVATION = 482.1  
 FT. (1909)

Q100=6.2 CFS  
 TC=13.0 MIN  
 SEE HYDROLOGY  
 STUDY FOR  
 EXISTING CONDITION